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(54) Method and curing mold for manufacturing road vehicle tires.

(57) During manufacture of a road vehicle tire (2), two annular supports (6, 7) of respective bead portions (8) of the tire (2) being formed are engaged by a bladder module (15) as the tire (2) is formed inside a forming mold (3); the module (15) presenting a tubular frame (22) supporting a curing bladder (21) and defining, with the forming mold (3), a curing mold (1) which is fitted and gripped between two opposite portions (17, 18) of a curing unit (16), and is removed from the unit (16), together with the tire (2), after curing.

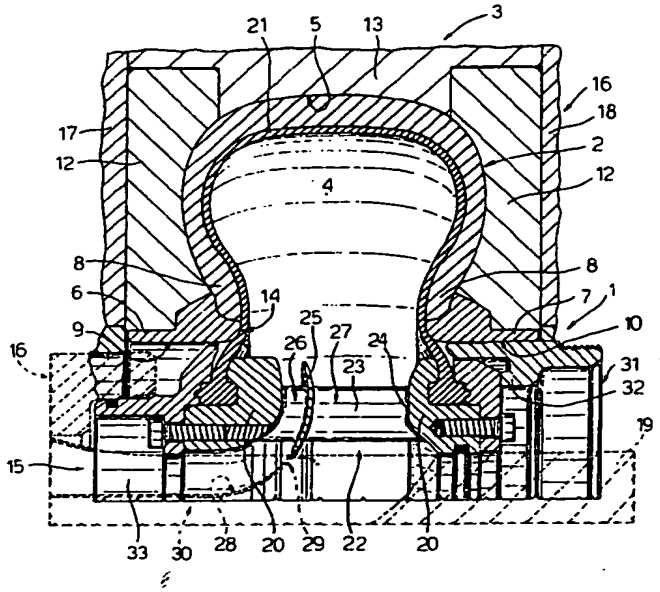

Fig.5

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The present invention relates to a road vehicle tire manufacturing method.

Italian Patent Application n. TO91A 000820, to which full reference is made herein in the interest of full disclosure, relates to a road vehicle tire manufacturing process whereby a green tire is assembled inside an annular forming mold having a toroidal inner chamber negatively reproducing the surface of the finished tire.

According to the above patent, the forming mold is fitted and gripped between two opposite portions of a curing unit having a curing bladder, which is inserted inside the tire and mold, and defines part of a heat exchange gas circuit. At the end of the curing stage, the curing unit is opened, the bladder removed from the tire, and the tire unloaded off the curing unit together with the forming mold inside which the tire is housed pending completion of the post-inflation stage.

Obviously, for producing tires of different sizes, the curing unit must be opened, allowed to cool for changing the bladder, and then reheated to the required temperature prior to commencing the next production cycle, thus resulting in considerable downtime and energy consumption.

It is an object of the present invention to provide a road vehicle tire manufacturing method designed to substantially eliminate the aforementioned drawback.

More specifically, it is an object of the present invention to provide a method enabling size changes to be effected with a relatively negligible loss of time and with no need for cooling the curing unit.

According to the present invention, there is provided a road vehicle tire manufacturing method, characterized by the fact that it comprises stages consisting in fitting a bladder module to two annular supports of respective bead portions of the tire being formed; said two annular supports defining an inner peripheral portion of an annular mold for forming said tire; the module being inserted inside said forming mold through said annular supports; the module comprising an outer annular bladder, and a tubular inner frame supporting the bladder and fittable in sliding manner to said inner annular supports; said bladder being a curing bladder; and the module defining, with the forming mold, a curing mold, which is fitted and gripped between two opposite portions of a curing unit, and is removed from the curing unit together with the tire upon completion of the curing process.

According to a preferred embodiment of the above method, the module is inserted through said annular supports during the formation of said tire.

The present invention also relates to a curing mold for manufacturing tires according to the above method.

According to the present invention, there is provided a curing mold for manufacturing road vehicle tires, said curing mold comprising an annular forming mold having a peripheral inner annular portion defined by two inner annular supports for respective bead portions of a tire housed, in use, inside the forming mold; characterized by the fact that it also comprises a bladder module comprising an outer annular bladder, and a tubular inner frame supporting the bladder and fitted in sliding manner to said inner annular supports; said bladder being a curing bladder; and the module being one of a number of modules of different sizes.

A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Fig.s 1 to 4 show schematic views of successive stages in the method according to the present invention;

Fig.5 shows an axial half section of a preferred embodiment of the curing mold according to the present invention.

Number 1 in Fig.s 3 and 5 indicates a curing mold for housing a tire 2 during part of its formation, as well as during curing and postinflation.

Curing mold 1 comprises a forming mold 3 having a toroidal inner chamber 4 inside which tire 2 is formed in known manner with its outer surface contacting a surface 5 of chamber 4 negatively reproducing the shape of tire 2.

More specifically, mold 3 comprises a first and second inner annular support 6 and 7 supporting respective bead portions 8 of tire 2. Annular supports 6 and 7 are defined internally by respective cylindrical surfaces 9 and 10 coaxial with axis 11, and are connected releasably to the inner edge of respective annular plates 12, the outer edges of which are connected releasably to respective axial ends of an outer annular body 13. Together with annular plates 12 and annular supports 6 and 7, annular body 13 defines toroidal chamber 4, which is accessible through an annular opening 14 defined between annular supports 6 and 7 and extending about axis 11.

In addition to mold 3, curing mold 1 also comprises a bladder module 15, which, as explained in more detail later on, is fitted to annular supports 6 and 7 during the formation of tire 2 and prior to fitting mold 1 to a known curing unit 16 comprising, as shown in Fig.4, a first and second opposed portion 17 and 18 for gripping mold 1. More specifically, portion 17 presents an axial core 19 projecting from portion 17 towards portion 18 and designed to engage mold 1 and portion 18 in sliding manner.

As shown more clearly in Fig.5, module 15 is substantially tubular, and comprises two annular

clamping elements 20 located inwards of respective surfaces 9 and 10 and engaging the opposite annular beads of a curing bladder 21 extending, in use, through opening 14 and inside toroidal chamber 4. Module 15 also comprises a tubular inner frame 22 fitted at opposite ends with annular elements 20 and defined by a number of axial rods 23 connecting annular elements 20. Rods 23 also define a number of axial openings 24 facing annular opening 14 and each divided by a transverse wall 25 into two openings 26 and 27.

As shown in Fig.5, when mold 1 is fitted in the curing position to core 19, openings 26 and 27 respectively connect chamber 4, through opening 14, to the supply and return conduits 28 and 29 of a forced-circulation circuit 30 formed at least partially in known manner on core 19, for forcing heat exchange fluid inside bladder 21.

At one end, module 15 is centered in relation to mold 3 by an auxiliary ring 31 fitted between surface 10 and respective annular element 20 and having an inner annular rib 32 cooperating axially with annular element 20, for preventing withdrawal of module 15 from mold 3 through annular support 7. On the opposite end to that fitted to ring 31, frame 22 presents an annular appendix 33 for centering module 15 in fluidtight manner on to portion 17 of unit 16.

As shown in Fig.1, carcass 34 of tire 2 is set up in assembly station 35 featuring a number of modules 15 of different sizes, only one of which is shown for the sake of simplicity. Carcass 34 presents bead portions 8 already fitted to annular supports 6 and 7, and may be either unformed or already partially formed as shown in Fig.1.

In station 35, the appropriate module 15 is fitted inside carcass 34 through annular support 7, the inner surface 10 of which is larger in diameter than the outside diameter of elements 20, for enabling bladder 21 to be fitted through annular support 7.

As shown in Fig.2, bladder 21 and carcass 34 are then formed together at a second station 36, where carcass 34 is inserted inside a tread assembly 37 fitted to outer annular body 13, so as to form tire 2, which is closed between annular plates 12 which, by connecting annular supports 6 and 7 and annular body 13, simultaneously define forming mold 3 and curing mold 1.

As shown in Fig.4, mold 1 is fitted to core 19, and bladder 21, inserted inside tire 2 through opening 14, preferably by feeding pressurized fluid in known manner inside bladder 21, closes circuit 30 inside tire 2.

Once tire 2 is cured in known manner, unit 16 is opened, and mold 1, still housing cured tire 2 engaged by bladder 21, is unloaded off core 19 and fed to a post-inflation station (not shown), while core 19 is fitted with a further mold 1 housing a further tire 2, not necessarily the same as cured tire 2.

Consequently, by virtue of bladder 21 not being integral with core 19 but forming part of module 15, and by virtue of module 15 being fitted to tire 2 off unit 16, the size changeover time, in itself negligible, has absolutely no effect on the operating cycle of unit 16, thus enabling unit 16 to be maintained at the required temperature, and, if necessary, a change in size from one tire to the next.

Claims

1. A road vehicle tire manufacturing method, characterized by the fact that it comprises stages consisting in fitting a bladder module (15) to two annular supports (6, 7) of respective bead portions (8) of the tire (2) being formed; said two annular supports (6, 7) defining an inner peripheral portion of an annular mold (3) for forming said tire (2); the module (15) being inserted inside said forming mold (3) through said annular supports (6, 7); the module (15) comprising an outer annular bladder (21), and a tubular inner frame (22) supporting the bladder (21) and fittable in sliding manner to said inner annular supports (6, 7); said bladder (21) being a curing bladder; and the module (15) defining, with the forming mold (3), a curing mold (1), which is fitted and gripped between two opposite portions (17, 18) of a curing unit (16), and is removed from the curing unit (16) together with the tire (2) upon completion of the curing process.

2. A method as claimed in Claim 1, characterized by the fact that the module (15) is inserted through said annular supports (6, 7) during the formation of said tire (2).

3. A method as claimed in Claim 1 or 2, characterized by the fact that said module (15) is selected from a number of modules (15) of different sizes.

4. A curing mold (1) for manufacturing road vehicle tires (2), said curing mold (1) comprising an annular forming mold (3) having a peripheral inner annular portion defined by two inner annular supports (6, 7) for respective bead portions (8) of a tire (2) housed, in use, inside the forming mold (3); characterized by the fact that it also comprises a bladder module (15) comprising an outer annular bladder (21), and a tubular inner frame (22) supporting the bladder (21) and fitted in sliding manner to said inner annular supports (6, 7); said bladder (21)

being a curing bladder; and the module (15) being one of a number of modules (15) of different sizes.

5. A curing mold (1) as claimed in Claim 4, characterized by the fact that said forming mold (3) comprises an outer annular body (13), said two annular supports (6, 7), and two lateral annular plates (12) connecting respective said inner annular supports (6, 7) to said outer annular body (13); said annular plates (12) defining, together with said inner annular supports (6, 7) and said outer annular body (13), a toroidal chamber (4) for housing said tire (2).

6. A curing mold (1) as claimed in Claim 5, characterized by the fact that said two inner annular supports (6, 7) define an annular opening (14) enabling external communication of said toroidal chamber (4) and the passage of said bladder (21) inside said tire (2).

7. A curing mold (1) as claimed in any one of the foregoing Claims from 4 to 6, characterized by the fact that said module (15) comprises two annular clamping elements (20) fitted to opposite axial ends of said bladder (21); said annular clamping elements (20) being integral with the opposite axial ends of said tubular frame (22), and being located substantially inwards of respective said inner annular supports (6, 7).

8. A curing mold (1) as claimed in Claim 7, characterized by the fact that said frame (22) comprises a number of parallel rods (23); each pair of adjacent rods (23) defining an axial opening (24) extending between said two annular clamping elements (20) and enabling external communication of said bladder (21).

9. A curing mold (1) as claimed in Claim 8, characterized by the fact that said tubular frame (22) comprises a transverse wall (25) dividing each said axial opening (24) into a first (26) and second (27) portion.

10. A curing mold (1) as claimed in any one of the foregoing Claims from 7 to 9, characterized by the fact that each annular clamping element (20) presents an outside diameter smaller than the inside diameter of the respective said inner annular support (6, 7); an auxiliary lock ring (31) being provided between one said annular clamping element (20) and the respective said inner annular support (6, 7).

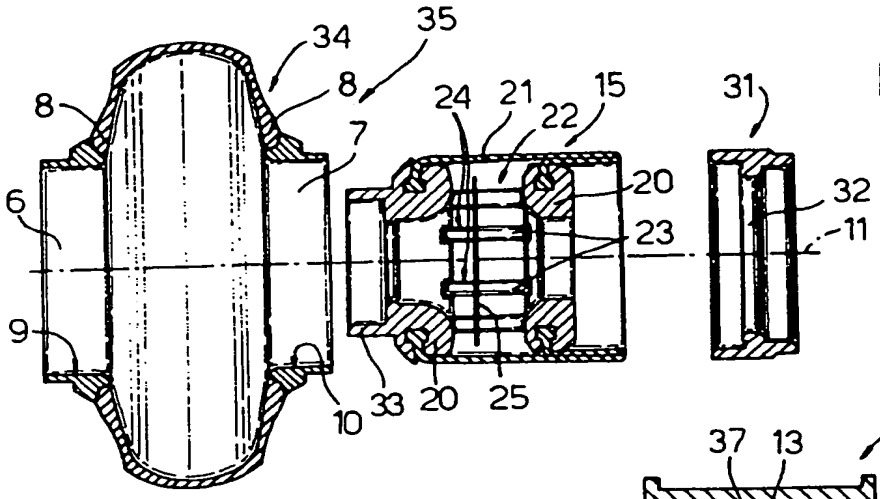


Fig.1

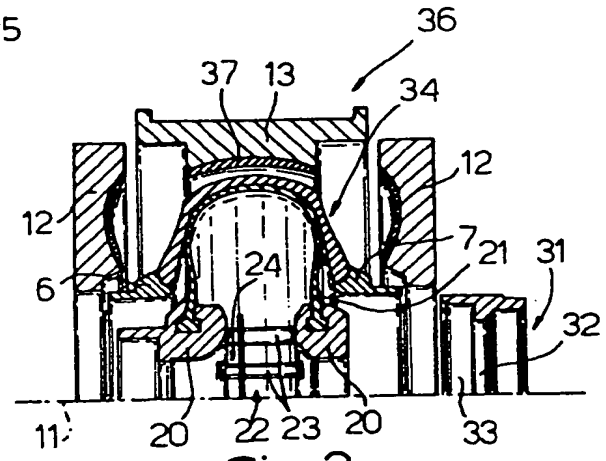


Fig. 2

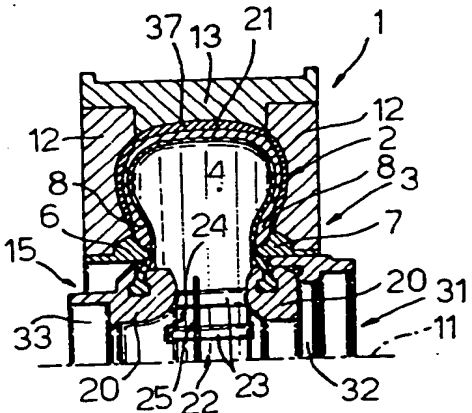


Fig. 3

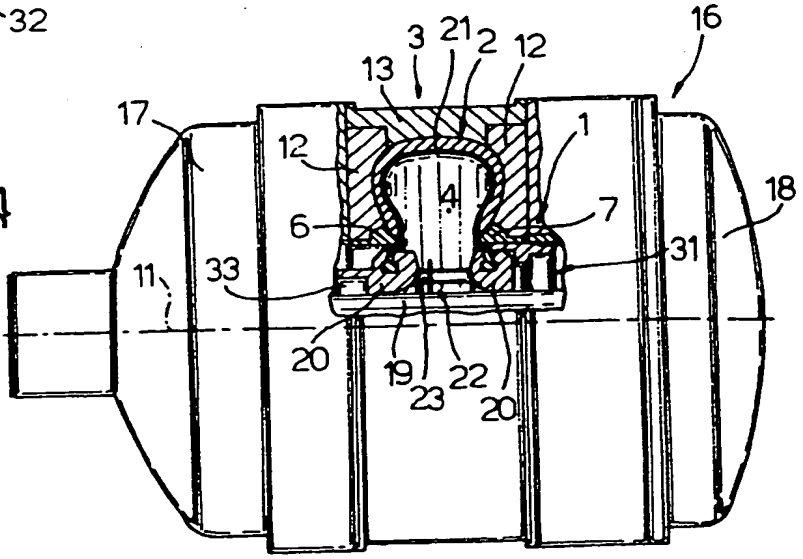
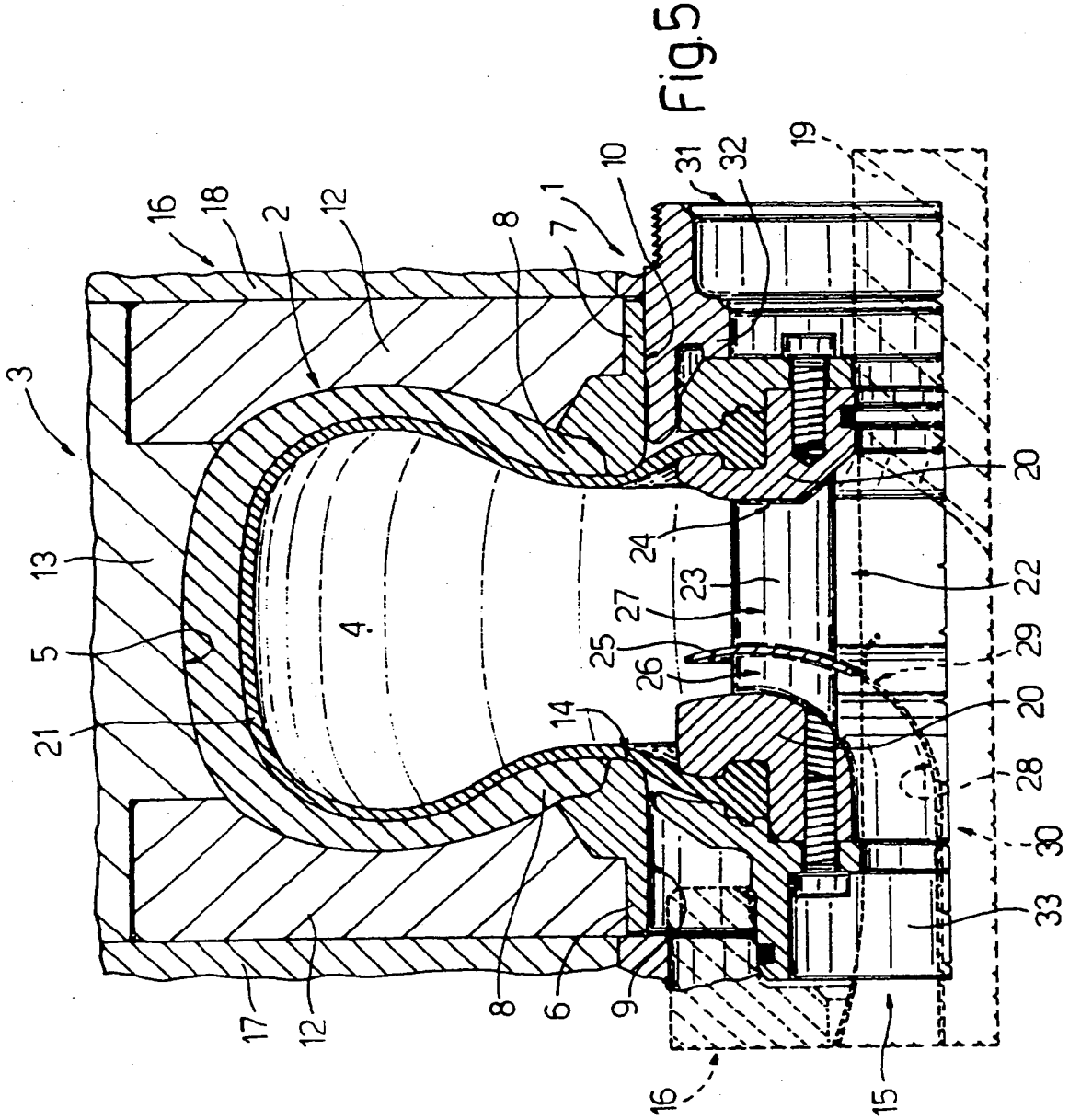


Fig.4

Fig.5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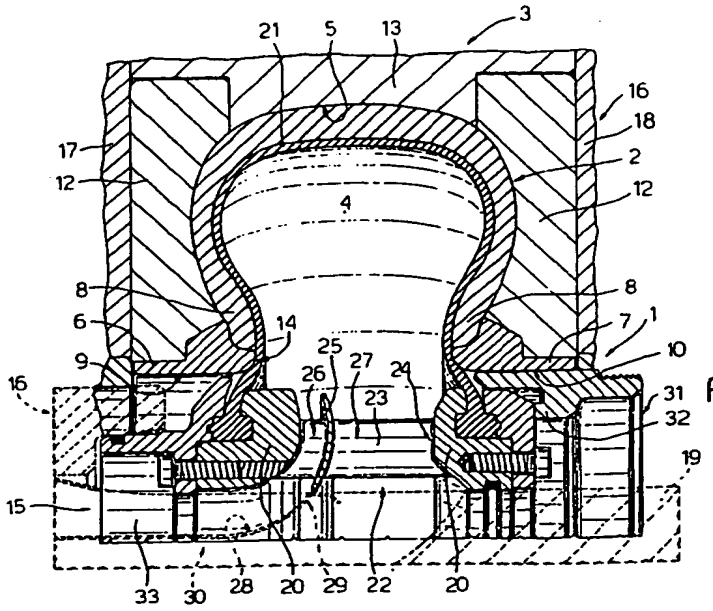

Fig.5

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EUROPEAN SEARCH REPORT

Application Number

DOCUMENTS CONSIDERED TO BE RELEVANT

EP 93110349.3

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	GB - A - 2 120 967 (SUMITOMO) * Totality * --	1,4-6	B 29 C 35/02// //B 29 L 30:00
A	EP - A - 0 246 495 (FIRESTONE) * Totality * --	1,4,9	
A	DE - A - 2 900 717 (THE GENERAL TIRE & RUBBER CO.) * Totality * ----		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B 29 C
B 29 D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	30-12-1993	MAYER

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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